U. S. FOREST SERVICE

RESEARCH NOTE NC-8

NORTH CENTRAL FOREST EXPERIMENT STATION, FOREST SERVICE—U.S. DEPARTMENT OF AGRICULTURE

Folwell Avenue, St. Paul, Minnesota 55101

Firebreak Maintenance With Soil Sterilants

In 1959 and 1962 the Minnesota Division of Forestry and the North Central Forest Experiment Station established a series of tests to determine the effectiveness of several herbicides in maintaining firebreaks free of vegetation. The primary objectives of these tests were to determine: (1) how long one application of soil sterilant can keep firebreaks satisfactorily free of vegetation and (2) how much chemical firebreak maintenance will cost. The tests continue a study on chemical firebreak maintenance which began in 1955.[1]

Establishment of Study. Areas selected for treatment represented difficult conditions for herbicidal control of vegetation as well as flashy fuel types. In 1959, tests were installed near Palisade, Minn., on two sites: (1) an undisked upland site with a sandy loam soil and bracken fern, sedge, and clover as the dominant vegetation and (2) a lowland peat site with grass, sedge, and moss as the dominant vegetation. On each site four chemical treatments were randomly allocated to 10x10-foot plots and replicated four times.

The 1962 plots, 12x55 feet, were installed on two disked, sandy loam sites east of Hill City, Minn. One site was almost entirely covered with grass, and the other was predominantly covered with bracken. Treatments were randomly applied to plots and replicated four times.

Granular chemicals were applied with a hand spreader. Wettable powders were mixed with a volume of water sufficient to provide for an application rate of 200 gallons per acre. Both hand-operated and gasoline-powered sprayers which created 200 p.s.i. pressure were used. Rate of application and chemical formulations are shown in table 1.

Plots were evaluated in the spring and fall according to their effectiveness as a firebreak and the percent of plot area occupied by vegetation. Firebreak effectiveness was rated according to the following categories (fig. 1):

1. G (good)—vegetation absent or sparse; a fire could not cross on fuel in plot.
2. I (intermediate)—vegetation present but not continuous; a fire might be able to cross under adverse fire weather conditions.
3. P (poor)—vegetation present and continuous across at least a portion of the plot; a fire could easily carry across the plot.

Percent of vegetation growing on plots was visually estimated, using vegetation on adjacent undisked soil as a reference with a rating of 100 percent. A treatment was reapplied when at least two of the four plots receiving it rated poor.

Effectiveness of Chemicals. The best control of vegetation, using one application of soil sterilant, was obtained with Ureabor (tables 2 and 3). Karmex and Simazine(80W) provided less effective control and Urox still less effective than Ureabor. Garlon and Simazine(50) yielded poor results, affording very short control of vegetation.

On the Hill City plots where dense bracken was present, only Ureabor showed promise of maintaining firebreaks free of this tough-to-kill plant. On plots dominated by upland grass, a single application of Ureabor produced the longest period of good control. However, two treatments of Urox, about as expensive as one treatment of Ureabor, furnished nearly 3 years of good control.

On the upland Palisade plots, two applications of Karmex in successive years provided 5 years of good control. One application of Ureabor provided 3 years

[1] *Gaylord, G., and E. I. Roe. Sodium borates show promise for grass control. U.S. Forest Serv., Lake States Forest Exp. Sta. Tech. Note 515, 2 pp. 1958.*

Gaylord, G., and E. I. Roe. Tests of some chemicals for grass control on firebreaks. U.S. Forest Serv., Lake States Forest Exp. Sta. Tech. Note 516, 2 pp. 1958.

Table 1.—Chemical formulation and cost of herbicides applied at rates recommended by manufacturers

Chemical[1]	Active formulation	Per acre[2]	
		Rate	Cost
Garlon	Diethylene glycol bis 2-2 dichloropropionate and 2(2,4,5-trichlorophenoxy) propionic acid	5 gals.	$ 33.00
Karmex(80W)	Diuron (3-(3,4-dichlorophenyl)-1,1-dimethyl urea)	50 lbs.	127.50
		37-1/2 lbs.	95.62
		31-1/4 lbs.[3]	79.69
Simazine(50)	2-chloro-4, 6-bis-(ethylamino)-s-triazine	20 lbs.	(4)
Simazine(80W)	2-chloro-4, 6-bis-(ethylamino)-s-triazine	50 lbs.	122.50
		37-1/2 lbs.[3]	91.88
Ureabor 31	Disodium tetraborate pentahydrate, disodium tetraborate decahydrate, 3-(p-chlorophenyl)-1, 1-dimethylurea, 2,3,6-trichlorobenzoic acid and related isomers	871 lbs.	261.36
		652 lbs.[3]	196.02
Urox 22	Monuron trichloroacetate ((3-p-chlorophenyl)-1, 1-dimethylurea trichloroacetate)	150 lbs.	124.50

[1] Trade names are used solely for information. No endorsement by the U.S. Department of Agriculture is implied.
[2] One acre corresponds to a strip of firebreak 12 feet wide and 0.7 mile long.
[3] These lower rates are for reapplications subsequent to initial treatment.
[4] Data not available.

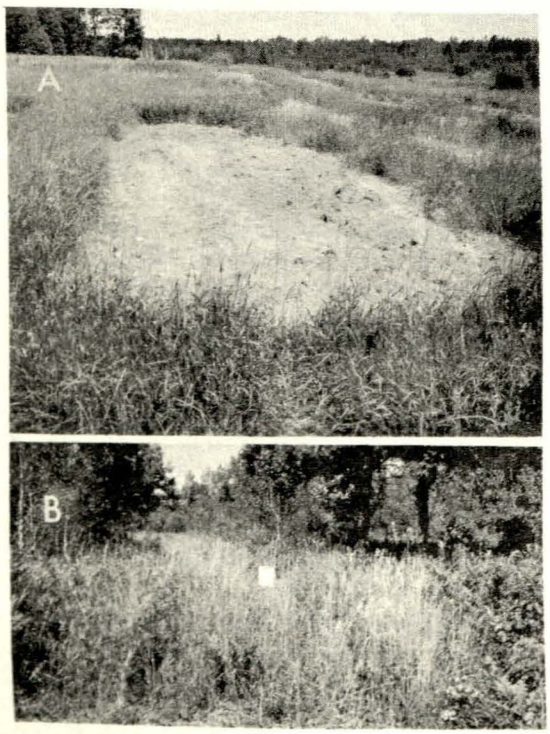

Figure 1.—Two plots treated for control of vegetation. Firebreak effectiveness and percentage of area covered with vegetation were estimated respectively as follows: *A* (near Hill City, Minn.)—good, 5 percent; *B* (near Palisade, Minn.)—poor, 95 percent.

of good control but a second and lighter application only 1 year of good control.

Control of marsh vegetation on peaty soil was unsuccessful with two repeated treatments of soil sterilants. Assuming rates of application reported for marsh plots in table 3, apparently at least three annual applications of Ureabor, Karmex, or similarly effective chemicals would be needed to provide 3 or more years of good control of marsh vegetation.

To avoid creating a strip of readily flammable dead plant material, soil sterilants should be applied to firebreaks on which the vegetative cover has been removed by disking or prescribed fire. The best time to apply soil sterilants for firebreak maintenance is in the spring before new growth emerges.

Timing in applying chemicals is important to successful control of vegetation. Ideally, a light rainfall should occur within a few days after treatment. A heavy rainfall occurring shortly after treatment washes away some chemical and reduces its effectiveness.

Cost Considerations. In selecting a soil sterilant for maintaining firebreaks, both effectiveness of single applications and cost of chemical treatment should be considered. Two applications of a comparatively inexpensive, moderately effective herbicide may control vegetation for a longer time than one application of a more expensive but very effective chemical. For

Table 2.—Treatment and evaluation of certain herbicides for maintaining firebreaks free of vegetation, Hill City, Minn.

Chemical	Date[1]	Grass type			Bracken type		
		Amount applied	Percent vegetation[2]	Firebreak effect[2]	Amount applied	Percent vegetation[2]	Firebreak effect[2]
		Pounds per acre			Pounds per acre		
Urox	S. '62	150	--	--	150	--	--
	F. '62		30	I		40	P
	S. '63	150	10	G	150	35	I
	F. '63		10	G		35	I
	S. '64		5	G	150	30	I
	S. '65		10	G		25	I
	F. '65		30	I		35	P
Simazine(80W)	S. '62	50	--	--	50	--	--
	F. '62		5	G		35	I
	S. '63		10	G		40	P
	F. '63		20	I		55	P
	S. '64		35	P	50	50	P
	S. '65		65	P		35	P
	F. '65		75	P		50	P
Karmex(80W)	S. '62	37-1/2	--	--	37-1/2	--	--
	F. '62		10	G		45	P
	S. '63		15	G		55	P
	F. '63		25	I		70	P
	S. '64		40	I	31-1/4	60	P
	S. '65		35	I		45	P
	F. '65		40	P		60	P
Ureabor 31	S. '62	871	--	--	871	--	--
	F. '62		5	G		5	G
	S. '63		0	G		10	G
	F. '63		0	G		25	I
	S. '64		10	G	652	5	G
	S. '65		40	I		0	G
	F. '65		30	I		5	G
Control	S. '62	--			--		
	F. '62		100	P		90	P
	S. '63		100	P		95	P
	F. '63		100	P		95	P
	S. '64		100	P		100	P
	S. '65		100	P		100	P
	F. '65		100	P		100	P

[1] S = spring. F = fall. Actual dates of application or reapplication were 5/1/62, 5/7/63, and 5/1/64.

[2] Average of four replicated plots.

example, two applications of Karmex should result in a longer period of control than one application of Ureabor (table 3). The chemical costs would be approximately the same (table 1). In comparing total costs of chemical treatments, the expense of handling, shipping, and applying chemicals should be taken into account.

Experience from this study indicates that the length of time good vegetation control can be obtained with one application of soil sterilant will vary with herbicide used, amount and timing of rainfall, and type of soil and vegetation present. At most, 3 years of good control can be obtained; but where tough-to-kill plants predominate treatments repeated every 1 or 2 years appear necessary. Herbicide manufacturers suggest that once good initial kill of vegetation is obtained, chemicals can be reapplied at lower concentrations than applied initially. Average annual costs of chemical firebreak maintenance would then be

Table 3.—Treatment and evaluation of certain herbicides for maintaining firebreaks free of vegetation, Palisade, Minn.

Chemical	Date[1]	Disked upland			Undisked marsh		
		Amount applied per acre	Percent vegetation[2]	Firebreak effect[2]	Amount applied per acre	Percent vegetation[2]	Firebreak effect[2]
Garlon	1959	10 gal.[3]	5	G	5 gal.	5	G
	1960	5 gal.	30	P	5 gal.		P
	1961			P			P
Simazine(50)	1959	20 lbs.	10	G	20 lbs.	55	P
	1960	20 lbs.	20	I	20 lbs.		P
	1961			P			P
Karmex(80W)	1959	50 lbs.	15	G	50 lbs.	5	G
	1960	50 lbs.	5	G	50 lbs.		P
	1961		5	G			G
	1962		5	G		35	I
	1963		10	G		50	I
	1964		70	P			P
	1965		70	P			
Ureabor 31	1959	871 lbs.	0	G	871 lbs.	10	G
	1960		10	G			P
	1961		15	G			P
	1962		60	P		100	P
	1963	652	0	G	652 lbs.	80	P
	1964		30	I			P
	1965		40	I			
Control	1959	--	95	P		100	P
	1960		100	P		100	P
	1961		100	P		100	P
	1962		100	P		100	P
	1963		100	P		100	P
	1964		100	P			
	1965		100	P			

[1] Actual dates of application or reapplication were 6/25/59, 8/8/59, 7/12/60, 7/20/60 (Garlon), and 5/7/63.
[2] Average of four replicated plots.
[3] Two 5-gallon applications were made, one in June and one in August.

lower, as an example, for a 10-year period than for a period of 3 or 4 years.

Soil sterilants are a possible means for maintaining firebreaks free of vegetation. In some circumstances they may prove as economical or even less costly than annual disking and are particularly useful where repeated disturbance of soil is undesirable.

July 1966

JAMES K. BROWN[2]
Associate Fire Control Specialist

[2] *Since this study was made, the author has been transferred to the Intermountain Forest and Range Experiment Station.*